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(21) International Application Number: PCT/US99/25834 (22) International Filing Date: 03 November 1999 (03.11.1999) (30) Priority Data: 09/186,028 04 November 1998 (04.11.1998) US (60) Parent Application or Grant ERICSSON INC. [/]; (). VASA, Suzy [/]; (). PLESSY, Kendra [/]; (). KARUTURI, Shridhar [/]; (). JOSEPH, Robin [/]; (). LINDGREN, Anders [/]; (). MOORE, Stanley, R. ; ().	Published	
(54) Title: CALLED NUMBER TRANSLATION (54) Titre: TRANSLATION DE NUMERO APPELE (57) Abstract <p>A system, method, and apparatus are provided for routing a request by a roaming mobile station is a visited public land mobile network (PLMN) after the mobile station has transmitted the request using an abbreviated number. The abbreviated number is received by the visited PLMN, which queries a database, such as a Service Control Point (SCP), and obtains a complete directory number, which is then used by the visited PLMN to route the request.</p> (57) Abrégé <p>L'invention concerne un système, un procédé, et un appareil permettant d'acheminer une demande effectuée par une station mobile itinérante dans un réseau mobile terrestre public (PLMN) visité, une fois ladite demande transmise par la station mobile à l'aide d'un numéro abrégé. Ce numéro abrégé est reçu par le PLMN visité, qui s'adresse à une station de base telle qu'un point de commande de services (SCP), et obtient un numéro d'annuaire complet, qui est ensuite utilisé par le PLMN visité, afin d'acheminer la demande.</p>		

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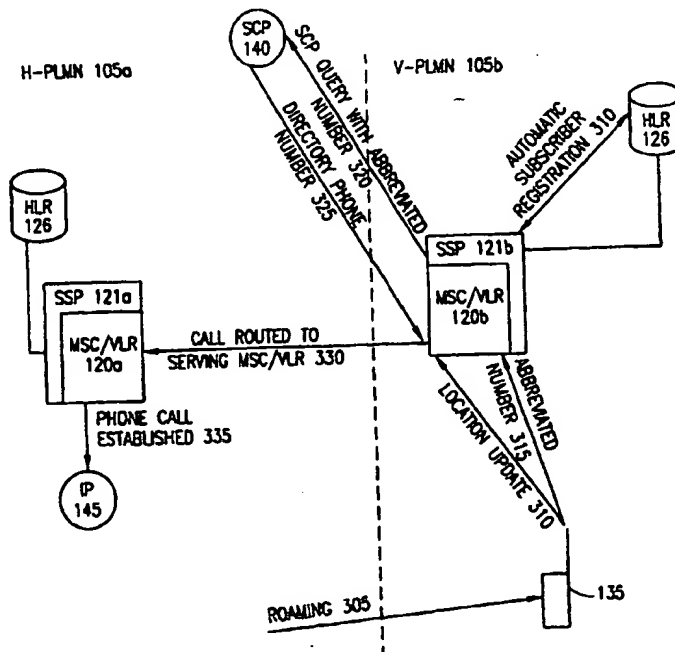
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(54) Title: CALLED NUMBER TRANSLATION

(57) Abstract

A system, method, and apparatus are provided for routing a request by a roaming mobile station is a visited public land mobile network (PLMN) after the mobile station has transmitted the request using an abbreviated number. The abbreviated number is received by the visited PLMN, which queries a database, such as a Service Control Point (SCP), and obtains a complete directory number, which is then used by the visited PLMN to route the request.



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Description

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CALLED NUMBER TRANSLATION

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates generally to routing requests in a wireless network, and more particularly to a procedure for routing requests from roaming subscribers.

Description of Related Art

In addition to offering telephonic services, most Public Land Mobile Networks (PLMNs) offer a variety of other communication services. For example, voice mail is a service whereby any party can leave a recorded voice message for the subscriber which is stored at a voice mail center. The voice mail center is usually connected as an Intelligent Peripheral (IP) to the PLMN and is accessible by establishing a phone call to a specific directory phone number associated with the voice mail center. A party can leave a voice message for a subscriber by calling the specific directory phone number, or more commonly, be forwarded to the voice mail center when calling the subscriber's phone number. The subscriber retrieves the message by establishing a call to the voice mail center using the directory phone number. Other examples of communication services include fax mail, and customer service, which can be connected as IPs with associated directory numbers to the PLMN and accessible by establishing a phone call to the directory phone number.

As a convenience to the subscriber, the subscriber is able to dial an abbreviated number, e.g., "133", to access a particular service. The abbreviated number is translated by a servicing Mobile Switching Center (MSC) to generate the directory phone number for the network node, i.e., the IP providing the particular service. The directory phone number is used as the called phone number, thereby establishing access to the particular services for the subscriber.

The key advantage of subscribing to a PLMN is the mobility of the communications services. A subscriber subscribing to a PLMN can make a phone call from anywhere within the geographic area of the PLMN. The geographic area covered by a PLMN generally covers the metropolitan area of a large city or even a sizeable portion of a state or province, thereby permitting the subscriber a substantial degree of mobility. However, a subscriber traveling to a different country is frequently beyond the range of the PLMN that the subscriber subscribes to. To provide service to the subscriber, the operators of a PLMN serving the geographic area where the subscriber is located (now referred to as the Visitor PLMN - V-PLMN) permit the subscriber to use the resources and infrastructure of the V-PLMN. The foregoing is known in the art as roaming.

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Because the servicing MSC in the V-PLMN is operated by a different party and not associated with the IP of the PLMN to which the subscriber subscribes (now referred to as the Home PLMN - H-PLMN), it is unlikely that the serving MSC in the V-PLMN is able to translate the abbreviated number received from the mobile station into the directory phone number to complete a call to an IP. Instead, the subscriber must dial the full directory phone number to access or call an IP. The foregoing is particularly cumbersome if the subscriber is in a different country where an international dialing prefix and a country code must be dialed in addition to the directory phone number. It would accordingly be advantageous for the subscriber to be able to utilize the same short number to access an IP as when the subscriber is in the H-PLMN.

It is therefore an object of the present invention to provide an improved system, method, and apparatus for simplifying subscriber access to IPs.

SUMMARY OF THE INVENTION

The present invention is directed to a system, method, and apparatus allowing a subscriber subscribing to a Home Public Land Mobile Network (H-PLMN) to use abbreviated numbers to access Intelligent Peripherals (IPs) when the subscriber is in a Visited PLMN (V-PLMN). A data structure is added in a Service Control Point (SCP) which cross-indexes a list of abbreviated numbers to a corresponding list of directory phone numbers. When an abbreviated number for a particular IP is received by a serving Mobile Switching Center/Visitor Location Register (MSC/VLR) in a V-PLMN from a mobile station subscribing to an H-PLMN 105a, the SCP is queried using the abbreviated number received from the mobile station. The SCP responds by transmitting the corresponding directory phone number of the IP. The MSC/VLR then uses the directory phone number transmitted by the SCP to establish a phone call to the particular IP.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be acquired by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1 is a block diagram of a plurality exemplary wireless networks within which the principles of the present invention may be supplemented;

FIGURE 2 is a block diagram of an exemplary Service Control Point (SCP) in accordance with the present invention; and

FIGURE 3 is a signal flow diagram of a Visited Public Land Mobile Network routing a request for service or call connection using a short number.

DETAILED DESCRIPTION OF THE DRAWINGS

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred exemplary embodiments. However, it should be understood that this class of embodiments provides only a few examples of the many advantageous uses of the innovative teachings herein. In general, statements made in the specification of the present application do not necessarily delimit any of the various claimed inventions. Moreover, some statements may apply to some inventive features but not to others.

Reference is now made to FIGURE 1 wherein there is shown a plurality of exemplary wireless networks, such as a Public Land Mobile Network (PLMN) 105, e.g., PLMNs 105a, 105b. The particular PLMN 105 utilized may include, for example, an Advanced Mobile Phone Service (AMPS) network, a Digital Advanced Mobile Phone Service (D-AMPS) network, or a Global System for Mobile Communication (GSM). As is well understood in the art, a particular PLMN 105 is composed of a plurality of Mobile Switching Center/Visitor Location Register (MSC/VLR) areas 115, e.g., MSC/VLR areas 115a and 115b, each with a Mobile Switching Center/Visitor Location Register (MSC/VLR) 120, i.e., MSC/VLRs 120a and 120b, respectively. Each MSC 120 is connected to a Gateway MSC 127 which connects the PLMN 105 to a public switched telephone network (PSTN) 129.

An MSC/VLR area 115 is a defined area in which a mobile station (MS) (terminal) 135 may move freely without having to send location update information to the MSC/VLR 120 that controls that MSC/VLR area 115. Mobile Station (MS) 135 is the physical equipment, for example a car phone or other portable phone, used by mobile subscribers to communicate with the cellular network 105, each other, and users outside the subscribed network, both wireline and wireless. Each MSC/VLR Area 115 is divided into a number of cells 138. The MSC 120 is in communication with at least one base station 150. The base station 150 is the physical equipment, illustrated for simplicity as a radio tower, that provides radio coverage to the geographical part of the cell 138 for which it is responsible.

With further reference to FIGURE 1, each PLMN 105 includes a Home Location Register (HLR) 126, e.g., HLR 126a in PLMN 105a and HLR 126b in PLMN 105b, which is a database maintaining and storing subscriber information such as subscriber profiles, current location information, International Mobile Subscriber Identity (IMSI) numbers, and other administrative information. The subscriber services associated with the mobile station 135 are defined in a subscriber profile that is stored in the HLR 126. The HLR 126 may be co-located with a given MSC/VLR 120, integrated with the MSC/VLR

120, or alternatively can service multiple MSC/VLRs 120, the latter of which is illustrated in FIGURE 1.

The VLR portion of the MSC/VLR 120 is a database containing information about all of the MSs 135 currently located within the MSC/VLR area 115. If an MS 135 moves from MSC/VLR area 115a to a new MSC/VLR area, for example, area 115b, the MSC/VLR 120b in MSC/VLR area 115b will request data about that MS 135 from the HLR database 126 (simultaneously informing the HLR 126 about the current location of the MS 135), for example, HLR 126b. Accordingly, if the user of the MS 135 then wants to make a call, MSC/VLR 120b in MSC/VLR area 115b has access to the requisite service profile information without having to reinterrogate the HLR 126. In the previously described manner, the MSC/VLR and HLR databases 120 and 126, respectively, contain various subscriber information associated with a given MS 135.

The PLMNs 105a, 105b have access to a database interface, known as a Service Control Point (SCP) 140. The SCP 140 acts as an interface to databases operated by the Public Switched Telephone Network. These databases are used to store information regarding subscriber services, call routing information, calling card validation, and fraud protection. In accordance with Intelligent Network (IN) specifications, the MSC/VLRs 120a, 120b are integrated with Service Switching Points 121a, 121b which are able to conduct database queries through the SCP 140 for various operations.

In addition to offering telephonic services, most PLMNs offer a variety of other communication services. For example, voice mail is a service whereby any party can leave a recorded voice message for the subscriber which is stored at a voice mail center. The voice mail center, as illustrated in FIGURE 1, can be connected as an Intelligent Peripheral (IP) 145 to the PLMN and is accessible by establishing a phone call to a specific directory phone number associated with the voice mail center. In this manner, the party can leave a voice message for a subscriber by calling the specific directory phone number, or more commonly, be forwarded to the voice mail center when calling the subscriber's phone number. The subscriber retrieves the message by establishing a call to the voice mail center 145 using the directory phone number, as is well understood in the art. Other examples of communication services include fax mail, and customer service, which can also be connected as IPs 145 with associated directory phone numbers to the PLMN 105.

As a convenience to the subscriber, the subscriber is able to dial an abbreviated number, e.g. "133", to access a particular service. The abbreviated number is translated by the MSC/VLR 120 to generate directory phone number for the IP 145 providing the particular service. The directory phone number is used as the called phone number, thereby establishing access to the particular services for the subscriber.

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The key advantage of subscribing to a cellular network, such as PLMN 105, is the mobility of the communication service. A subscriber subscribing to a PLMN, e.g., 105a, can make a phone call from anywhere within the geographic area of the PLMN 105a, i.e., area 115a. The geographic area covered by a PLMN 105a generally covers the metropolitan area of a large city or even a sizeable portion of a state or province, thereby permitting the subscriber a substantial degree of mobility. However, subscribers traveling to a different country are frequently beyond the range of their PLMN 105a. To provide service to the subscriber, the operators of a PLMN 105b serving the geographic area, i.e., area 115b, where the subscriber is located (now referred to as the Visited PLMN - V-PLMN), permit the subscriber to use the resources and infrastructure of the V-PLMN 105b, as if it were their home PLMN 105a. In this manner, roaming is supported.

However, because the MSC/VLR 120b in the V-PLMN 105b is operated by a different party and is not associated with the IPs 145 within the PLMN 105a to which the subscriber subscribes (now referred to as the Home PLMN - H-PLMN), it is unlikely that the MSC/VLR 120b would be able to translate an abbreviated number received from the now roaming mobile station 135 into the directory phone number to complete a call to the IP. Instead, the subscriber themselves must dial the directory phone number to access a call to the voice mail center. The foregoing is particularly cumbersome if the subscriber is in a different country where an international dialing prefix and a country code must be dialed in addition to the directory phone number. Therefore, it is preferable if the subscriber is able to utilize the same abbreviated number to access the voice mail when the subscriber is in the H-PLMN 105a, which is one of the advantages of the system, method and apparatus of the present invention.

To permit the user to use the same abbreviated numbers to access the IPs 145 when a PLMN 105a subscriber, for example, is in the V-PLMN 105b, the present invention proposes the addition of a data structure in the SCP 140 which cross-indexes a list of abbreviated numbers to a corresponding list of directory phone numbers. When an abbreviated number for a particular IP 145 is received by the MSC/VLR 120b in the V-PLMN 105b from the roaming MS 135 subscribing to H-PLMN 105a, SSP 121b queries the SCP 140 using the abbreviated number received from the MS 135. The SCP 140 responds by transmitting the corresponding directory phone number of the IP 145 to the SSP 121b. The MSC/VLR 120b then uses the directory phone number received from the SCP 140 to establish a phone call to the particular IP 145.

Referring now to FIGURE 2, there is illustrated a block diagram of an exemplary SCP 240 having a data structure, therein generally designated by the reference numeral 200, for cross-indexing abbreviated numbers 220 in an abbreviated number field 205 associated with IPs 145, as shown in FIGURE 1, to corresponding directory phone numbers in a directory

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phone number field 230, in accordance with the present invention. The data structure 200 includes any number of abbreviated numbers 220 cross-indexed with the aforementioned directory phone numbers 230. The SCP 140 can be queried by an SSP 121 to determine the directory phone number 230 corresponding to a given abbreviated number. The SCP 240 responds to the database query by looking up the abbreviated number 220 in the data structure 200 and retrieving the directory phone number 230 therefrom. The directory phone number 230 is then transmitted to the requesting SSP 121. The aforementioned database query allows the MSC/VLR 120b in the V-PLMN 105b to successfully route a request to access a particular IP 145 using an abbreviated number from the roaming mobile station 135 which subscribes to H-PLMN 105a.

Referring now to FIGURE 3, there is illustrated a signal flow diagram of the V-PLMN 105b routing a request for service or a phone call from the MS 135 using an abbreviated number. At initial step 305, for example, the MS 135 moves from the home geographic area 115a of H-PLMN 105a to the geographic area 115b of V-PLMN 105b. As is understood in the art, the MS 135 routinely transmits location update signals at regular time intervals. At step 310, the location update signal is detected by the V-PLMN 105b, triggering an automatic roaming subscriber registration in the V-PLMN 105b in a manner well known in the art. At step 315, the subscriber at MS 135 requests access to the IP 145 by dialing an abbreviated number, as is customary when within the H-PLMN 105a. The abbreviated number is received by the MSC/VLR 120b, which is currently serving the roaming MS 135 in the V-PLMN 105b. The MSC/VLR 120b examines the transmitted request and detects (1) that an abbreviated number has been received, and (2) that the subscriber at MS 135 is a roaming mobile subscriber. Therefore, in order for the MSC/VLR 120b to complete the request to access an IP 145, the MSC/VLR 120b must ascertain the directory phone number corresponding to the subscriber's abbreviation.

To ascertain the corresponding directory phone number for the abbreviated number received from MS 135, SSP 121b queries the SCP 140 using the abbreviated number (step 320). The SCP 140 responds by looking up the abbreviated number among the abbreviated numbers 220 stored in data structure 200 and retrieving the corresponding directory phone number 230 therefrom. The directory phone number corresponding to the abbreviated number received by the MSC/VLR 120b from the MS 135 is then transmitted to SSP 121b. (step 325). The MSC/VLR 120b can then use the corresponding directory phone number as the called number to route the phone call to the MSC/VLR 120a serving the IP 145 (step 330). The MSC/VLR 120a then completes the phone call connection to IP 145 (step 335).

Although the invention has been described with a certain degree of particularity, it should be recognized that elements thereof may be altered by persons skilled in the art without departing from the spirit and scope of the invention. For example, although the described

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embodiments illustrated abbreviated numbers and directory phone numbers referring to Intelligent Peripherals, it is noted that the present invention is not limited to Intelligent Peripherals and, indeed, in alternative embodiments, the abbreviated numbers and the directory phone numbers might not refer to Intelligent Peripherals. Therefore, the invention is limited only

5 by the following claims and their equivalents.

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Claims

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WHAT IS CLAIMED IS:

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1. A method for routing an abbreviated number request from a mobile station subscribing to a first Public Land Mobile Network (PLMN) roaming at a second PLMN, said method comprising the steps of:

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receiving, during said abbreviated number request, an said abbreviated number from said mobile station at said second PLMN;

querying a database of directory phone numbers using said abbreviated number, determining a particular directory phone number within said database associated with

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said abbreviated number; and

transmitting said particular directory phone number to said second PLMN.

2. The method of claim 1, wherein said step of receiving said abbreviated number at said second PLMN further comprises the step of receiving said abbreviated number at a

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Mobile Services Switching Center/Visitor Location Register (MSC/VLR).

3. The method of claim 1, further comprising the step of detecting, by said second PLMN, that said mobile station subscribes to said first PLMN.

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4. The method of 3, wherein said step of querying said database further comprises the step of querying, by said second PLMN, said database using said abbreviated number, responsive to detecting said mobile station subscribes to said first PLMN during said detecting step.

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5. The method of claim 1, wherein said step of querying said database further comprises the step of querying a Service Control Point.

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6. A Service Control Point (SCP) apparatus for routing abbreviated number requests from mobile stations, said SCP comprising:

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first storage means for storing a plurality of abbreviated numbers, each of said plurality of abbreviated numbers associated with telecommunications equipment;

second storage means for storing a plurality of directory phone numbers, each of said plurality of directory phone numbers corresponding with one of said plurality of abbreviated numbers; and

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retrieval means for retrieving one of said plurality of directory phone numbers responsive to receiving one of said plurality of abbreviated numbers, said one directory phone number corresponding to said one abbreviated number.

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7. The Service Control Point apparatus of claim 6, further comprising:
receiving means for receiving said one abbreviated number from a Public Land Mobile
Network (PLMN).

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5 8. The Service Control Point apparatus of claim 7, further comprising:
transmission means for transmitting said one directory phone number to said PLMN.

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9. A telecommunications system for routing an abbreviated number request from
a roaming mobile station subscribing to a Home Public Land Mobile Network (PLMN), said
telecommunications system comprising:

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a visited PLMN for serving said roaming mobile station, said visited PLMN receiving
an abbreviated number during said abbreviated number request;
a database for storing a data structure associating said abbreviated number with a
corresponding directory phone number; and
15 a signal link, connecting said visited PLMN and said database, for transmitting said
abbreviated number from said visited PLMN to said database and for transmitting said
corresponding directory phone number from said database to said visited PLMN.

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10. The telecommunications system of claim 9, wherein said database further
20 comprises a Service Control Point (SCP).

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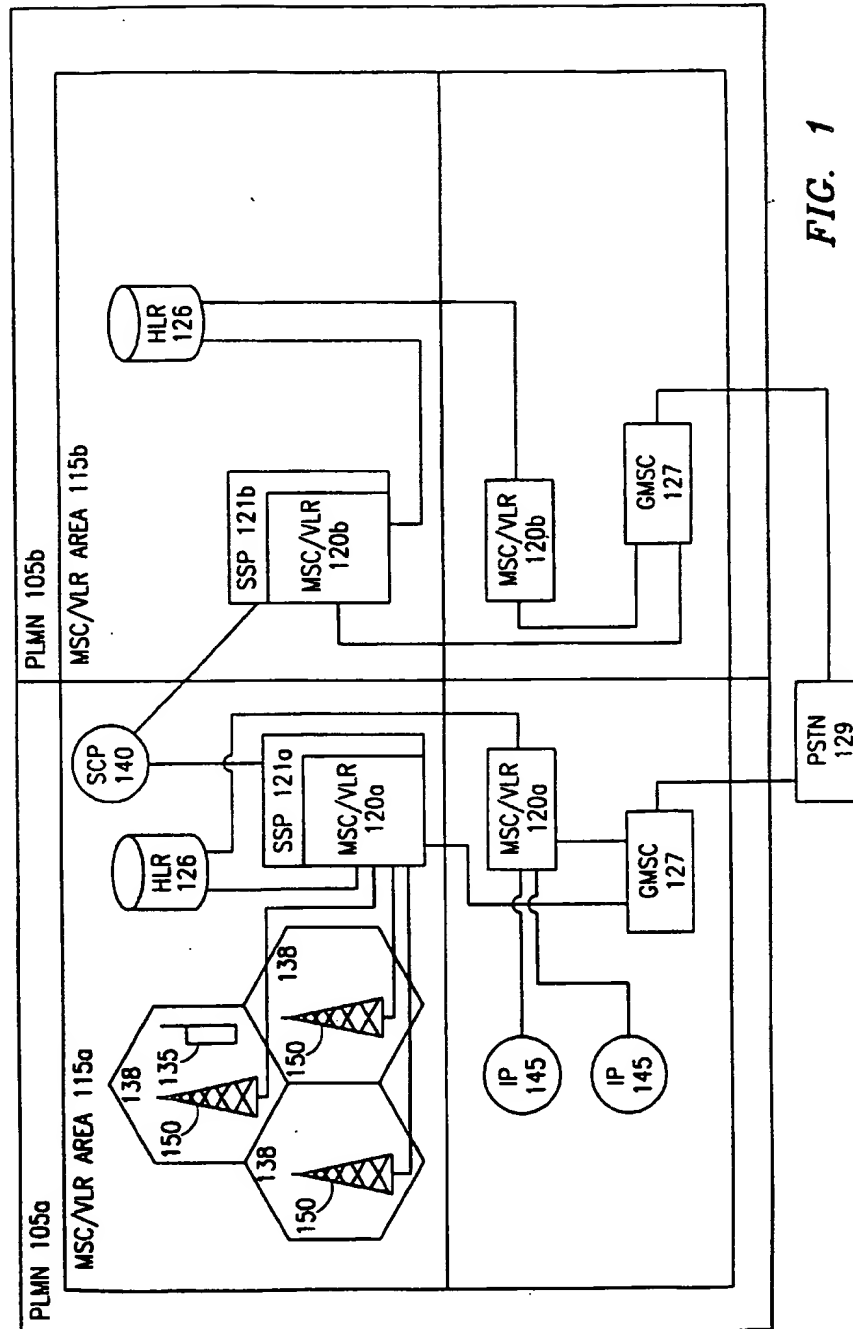
11. The telecommunications system of claim 9 wherein said database further
comprises:
a plurality of said abbreviated numbers, said plurality of abbreviated numbers, each of
25 said plurality of abbreviated numbers having an intelligent peripheral associated therewith;
a plurality of directory phone numbers, each of said plurality of directory phone
numbers corresponding with a respective one of said plurality of abbreviated numbers; and
40 retrieval means for retrieving one of said plurality of directory phone numbers, wherein
said one of said plurality of directory phone numbers corresponds to said abbreviated number
30 received by said visited PLMN.

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12. The telecommunications system of claim 11, further comprising transmission
means for transmitting said directory phone number from said database to said visited PLMN.

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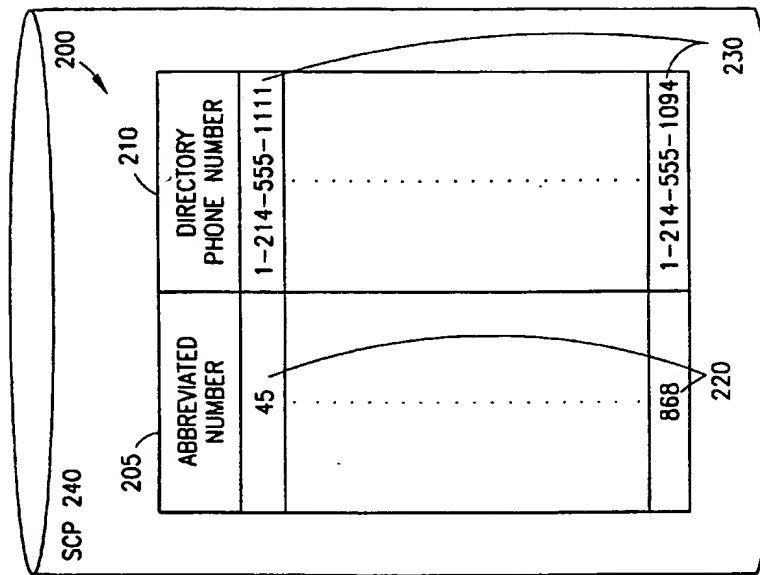


FIG. 2

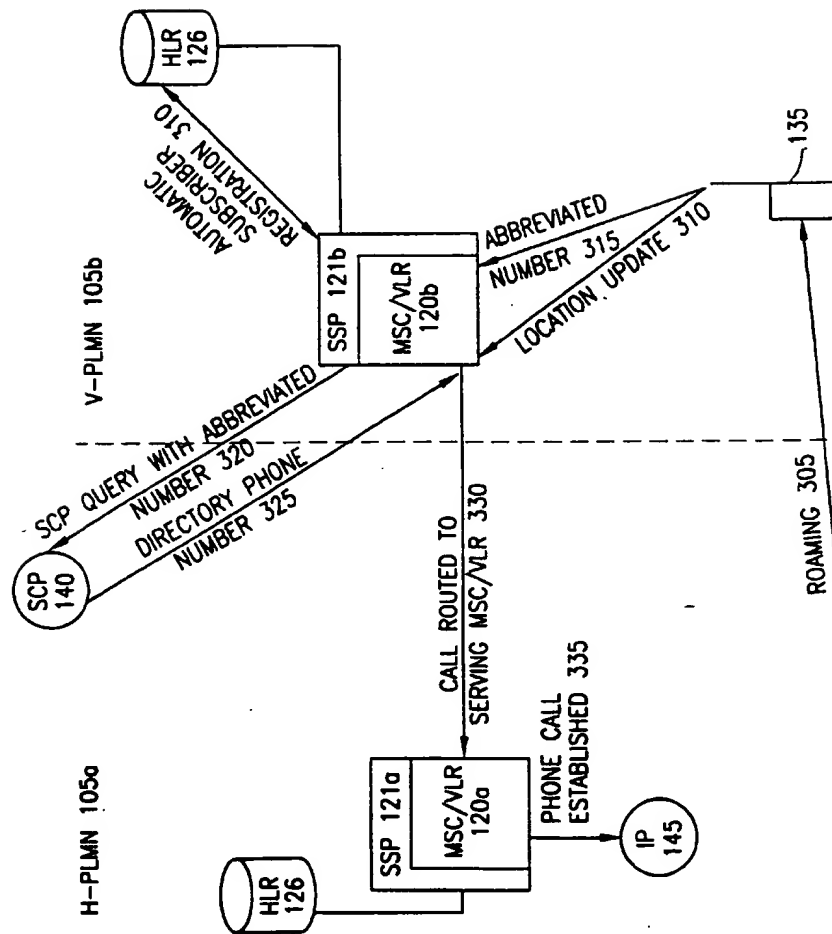


FIG. 3

INTERNATIONAL SEARCH REPORT

Internat. Application No.
PCT/US 99/25834

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SMITH D G: "AN INTRODUCTION TO GSM ENHANCEMENTS FOR OPERATOR SPECIFIC SERVICES (CAMEL)" 17 May 1996 (1996-05-17), IEE COLLOQUIUM ON MOBILE COMMUNICATIONS TOWARDS THE NEXT MILLENNIUM AND BEYOND XP000605991 page 2, line 1 - line 14 page 3, line 1 - line 5 page 4, line 18 - line 26 page 7; table 1	1-12
X	WO 96 13949 A (NOKIA TELECOMMUNICATIONS OY; HUOTARI SEPPA (FI); TURKULAINEN VELI) 9 May 1996 (1996-05-09) page 9, line 3 - line 33 page 11, line 23 - page 12, line 1 page 13, line 15 - line 28 page 14, line 2 - page 15, line 16 -/-	1-12

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

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24/02/2000

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INTERNATIONAL SEARCH REPORT

International Application No.
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C. (Combination) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>HOLLEY K A: "GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS - WHAT'S IN STORE?" BT TECHNOLOGY JOURNAL, GB, BT LABORATORIES, vol. 14, no. 3, 1 July 1996 (1996-07-01), page 47-54 XP000598154 ISSN: 1358-3948 page 50, right-hand column, line 28 -page 51, left-hand column, line 3 page 53, line 1 - line 13</p>	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/25834

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